The Development of a 20-year Database of Ocean Surface and Near-Surface Properties

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CDR Team Meeting
July 31 – Aug 2, 2012

Outline

- Project Description
- Production and QA Approach
- Applications
- Schedule & Issues

Project Description

- Describe at a high level what your CDR is (1-2 slides):
  - Include inputs, outputs, uncertainty estimates, temporal/spatial resolution, period of record, data format, gridding or projections, visualizations of output, collateral products, etc.
  - Fill out table (see next slide for format) and if needed, one slide of additional text

Project Description

- sea surface temperature and near-surface parameters of wind speed, temperature, and humidity → determination of the air-sea turbulent heat fluxes
- Source Data
  - AVHRR/AMSR (Reynolds +)
  - SSM/I
  - NSCAT/QuikSCAT/SeaWinds (CCMP)
  - Supporting data: solar radiation; ice flags; aerosols

Project Description

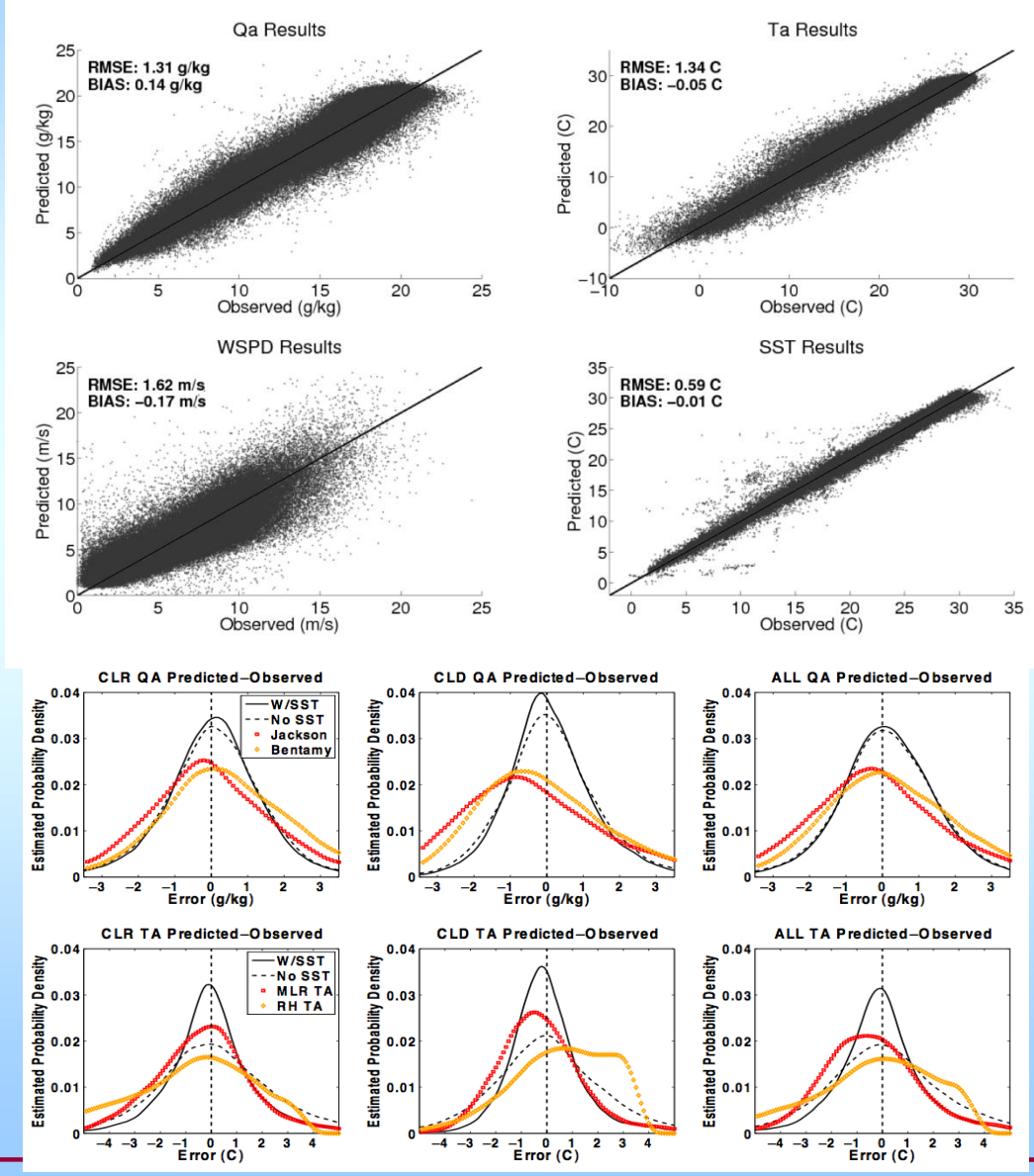
- 3 hourly, 0.25° resolution
- Current version:
  - 1998 – 2007
  - Uses previous version of CSU TBs
  - Binary format (matlab, IDL, C, Fortran reads available)
  - Currently producing uncertainty estimates
  - www.seaflux.org

Project Description

CDR(s) (Validated Outputs)	Period of Record	Spatial Resolution; Projection information	Time Step	Data format	Inputs	Uncertainty Estimates (in percent or error)	Collateral Products (unofficial and/or unvalidated)
SST	1998-2007	0.25° equal angle	3 hours	Binary	Reynolds, diurnal warming parameterization, SRB, GPCP	Estimated: 0.5° C	
Near-surface air humidity, winds, & temperature	1998-2007	0.25° equal angle	3 hours	Binary	SSM/I, SSMIS, ice flags, land flags	Estimated: Ta: 0.1 °C Qa: 0.2 g/kg U: 0.2 m/s	
Latent and sensible heat fluxes	1998-2007	0.25° equal angle	3 hours	Binary	SST, Ta, Qa, Winds	Estimated: LHF: 15 W/m^2 SHF: 10 W/m^2	

Approach: U, Ta, qa

- Use of neural net technique from SSM/I fields (Roberts et al. 2010)
- Gridding into equal-angle grids
- Interpolation using model gradients



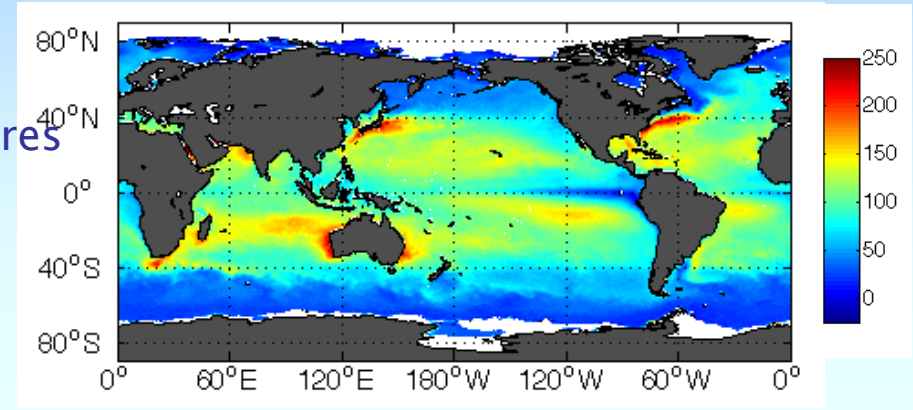
Approach: SST

- Creation of pre-dawn SSTs
  - Version 1: Reynolds
  - Version 2: perhaps other CDR?
- Diurnal cycle inclusion
  - Estimation by paramaterization – done for entire time period
  - Objective gridding of additional satellite information (AMSR, TMI, SSM/I)
- Production of final gridded SST datasets

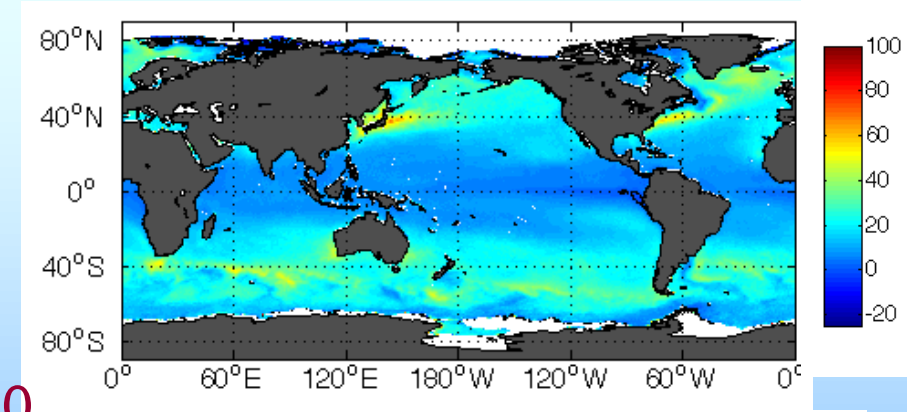
SeaFlux Climatological Data Set Version 1.0

- Near-surface air temperature and humidity
  - Roberts et al. (2010) neural net technique
  - SSM/I only from CSU brightness temperatures (thus only covers 1997 - 2006)
  - Gap-filling methodology -- use of MERRA variability – 3 hour
- Winds
  - Uses CCMP winds (cross-calibrated SSM/I, AMSR-E, TMI, QuikSCAT, SeaWinds)
  - Gap-filling methodology -- use of MERRA variability – 3 hour
- SST
  - Pre-dawn based on Reynolds OISST
  - Diurnal curve from new parameterization
  - Needs peak solar, precip
- Uses neural net version of COARE 3.0
- available at http://seaflux.org

1999 Latent Heat Flux



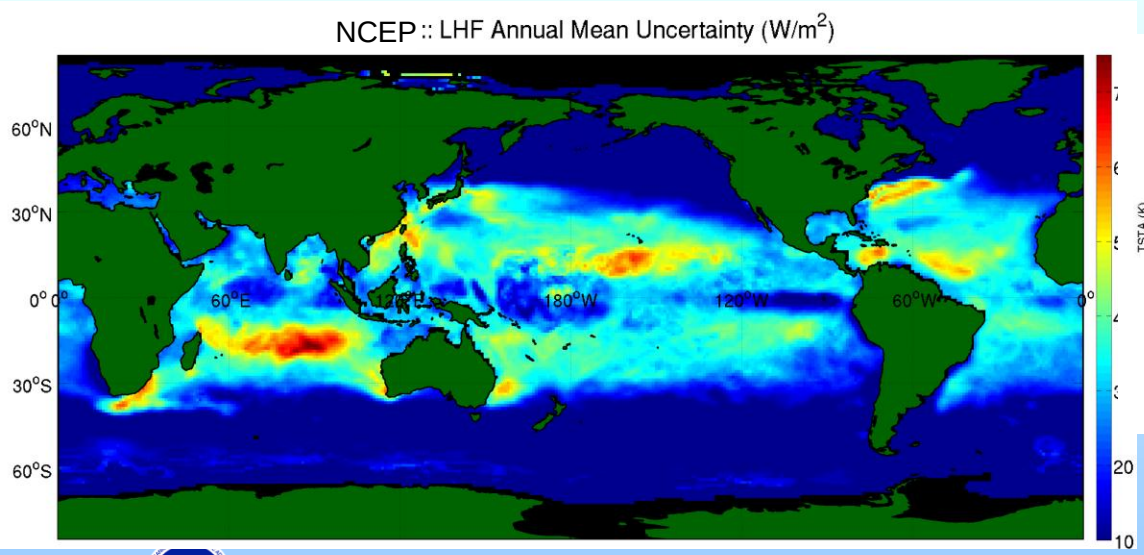
1999 Sensible Heat Flux

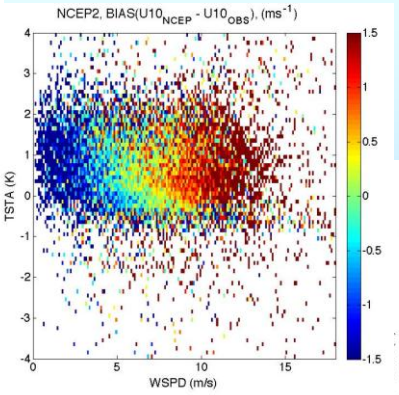


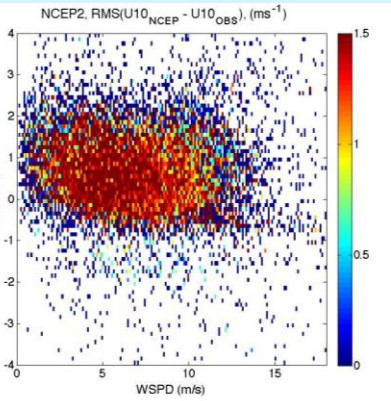
SEAFLUX

Uncertainty Approach

- Matchups with in situ observations -- errors
- Joint PDFs of errors (systematic error and rms error)
- Use product (ensemble average of other products) to calculate estimated values
- Apply error propagation equation to calculate systematic and random errors → on daily scale since source products at that resolution







Specific Challenges/Issues to be Addressed

- Which TB dataset to use?

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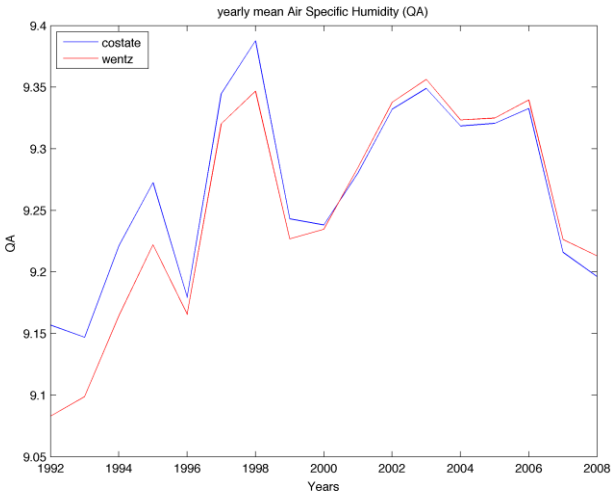
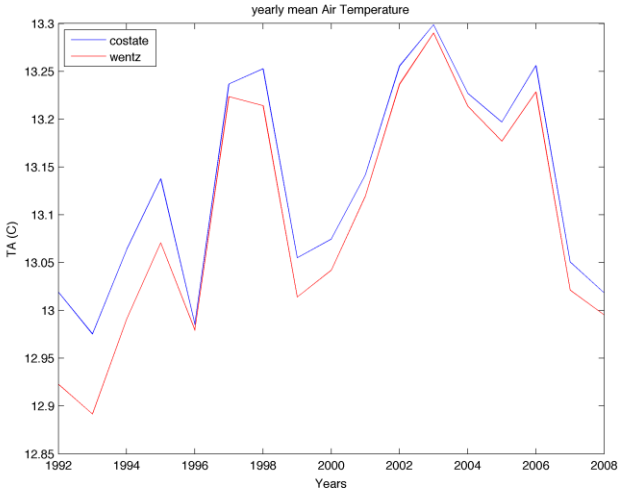
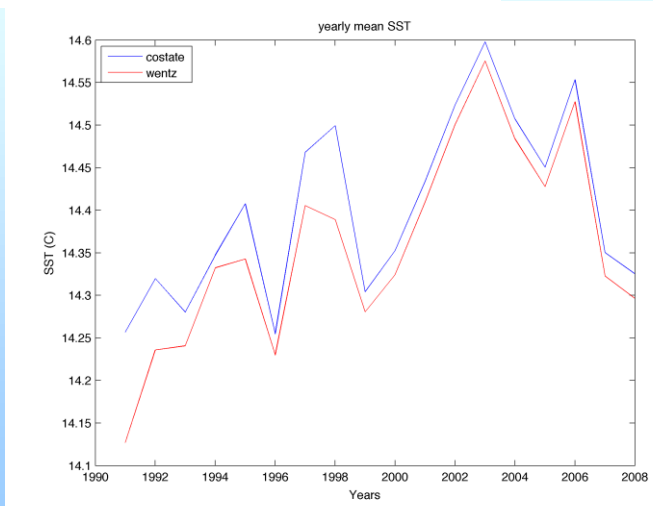




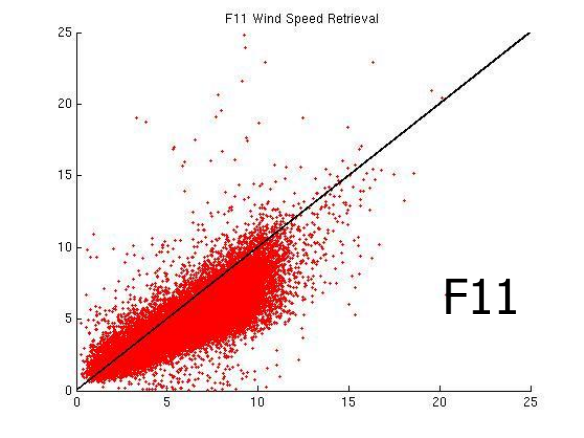


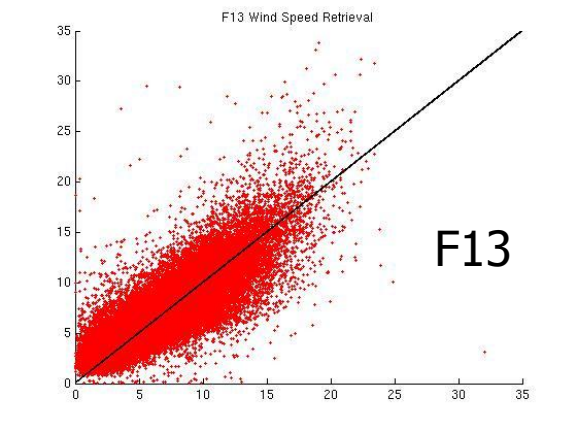
Specific Challenges/Issues to be Addressed

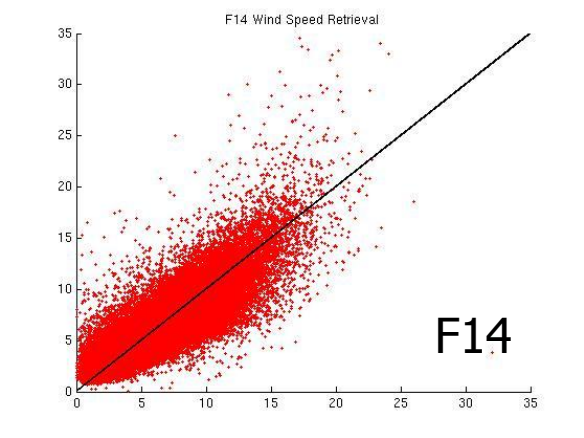
- Which TB dataset to use?
- CCMP vs our winds
- SST issues: base SST?

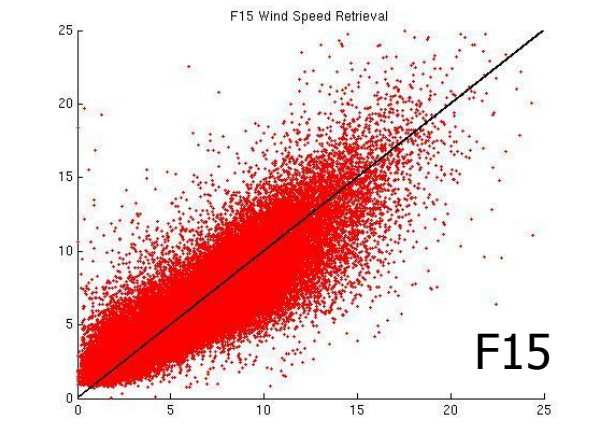
Quality Assurance Approach

- Statistical analysis
  - Scatter plots satellite to satellite vs in situ
  - Long term trends (other satellite products, ship-based products, model products)



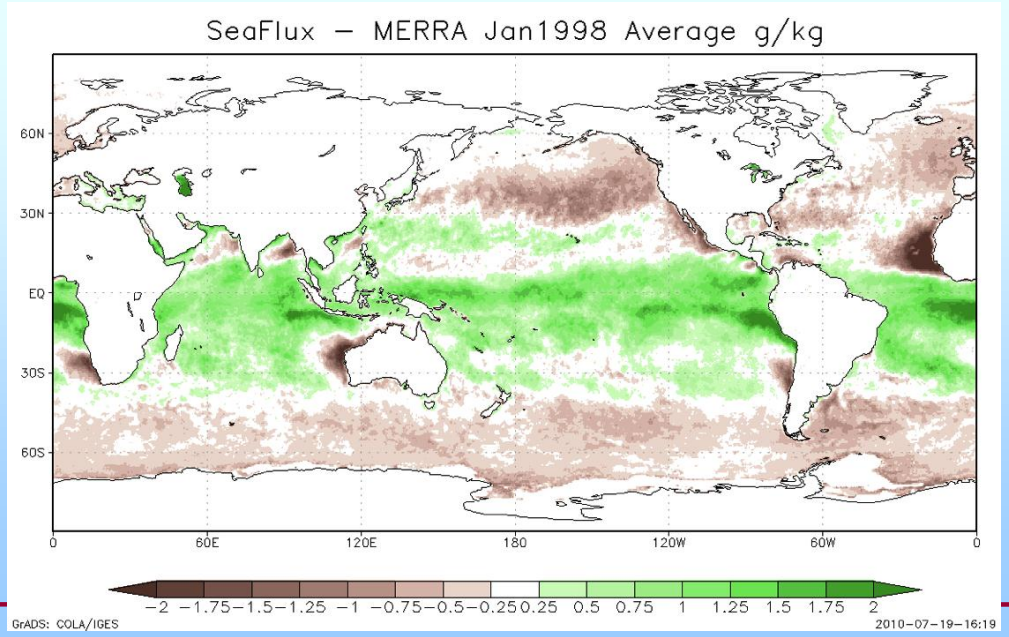






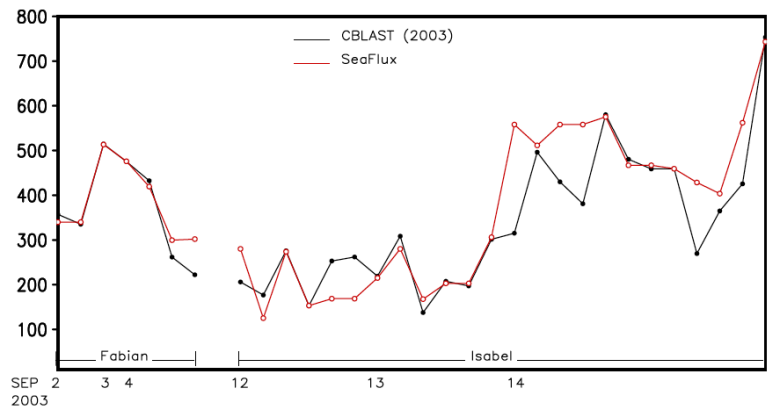
Benefit to the Science Community

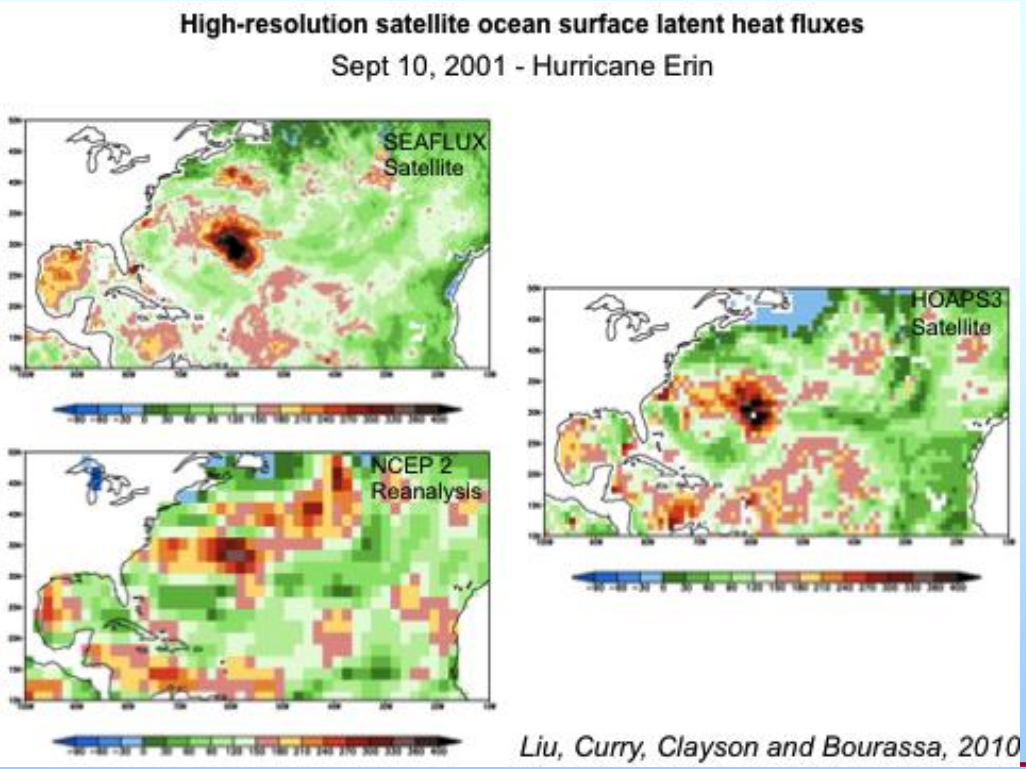
- Science user communities
  - GEWEX, SeaFlux, CLIVAR, SOLAS, NASA NEWS, GHRSST, SOLAS
  - ocean modelers, climate modelers and those analyzing output
  - energy and water cycle studies, climate analyses
- Several examples
  - An analysis of extremes, for instance hurricanes (see Lu et al. 2011)
  - Comparisons with MERRA (Roberts et al. 2011)
  - New global analysis of water, heat cycles (NASA NEWS, Stephens paper)
  - Understanding of distributions of near-surface properties including fluxes and how they evolve over time (we are just ramping up this work)



Benefit to Society

- High-resolution structure of the lower atmosphere including heat and water air-sea exchanges during storms
  - Hurricanes (Lu et al. 2011)
  - Mid-latitude storms (Scott et al. 2011)

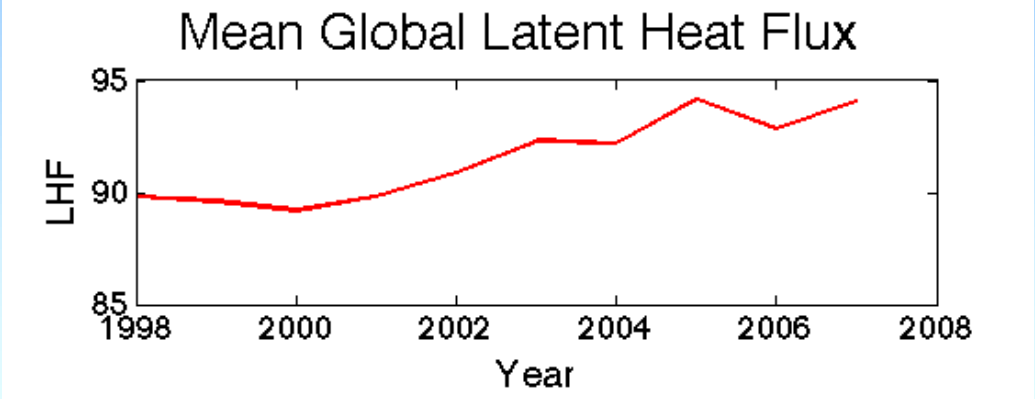


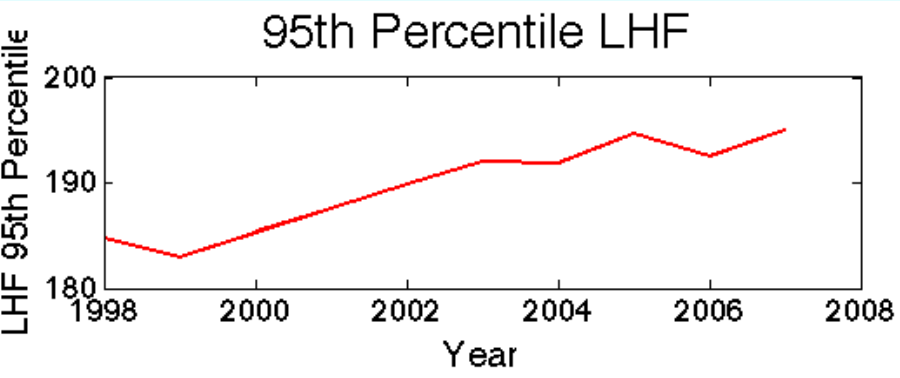


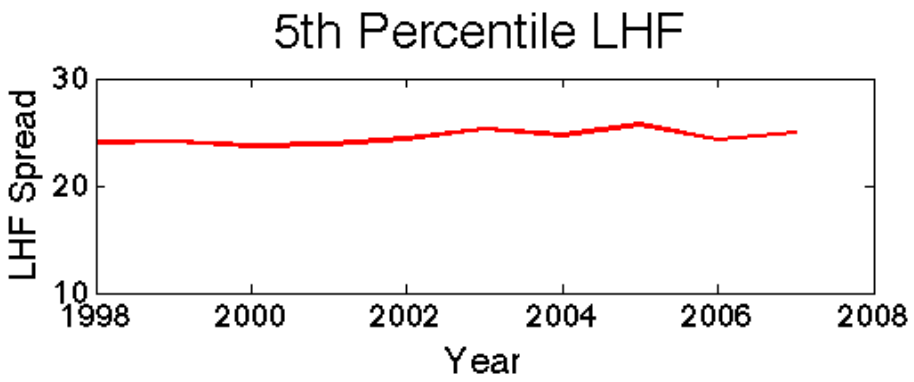
Benefit to Society

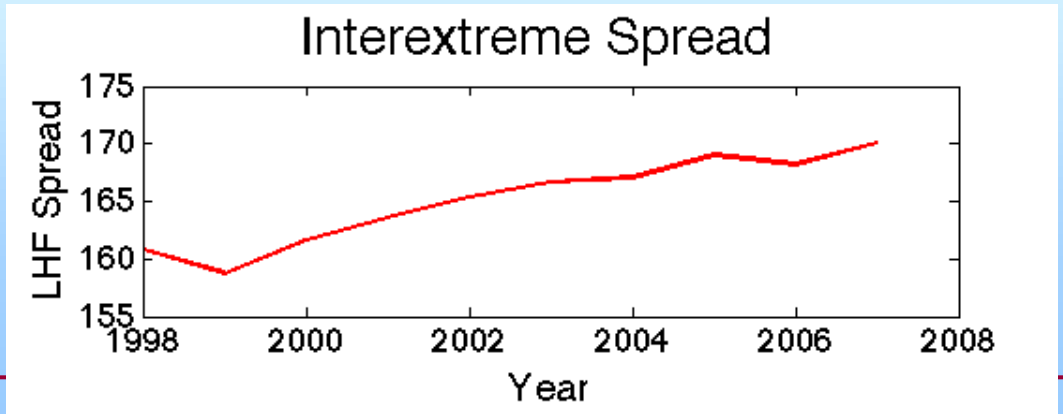
- Sectors
  - Most obvious societal sector is Water. We fundamentally need to know if water cycle is changing, and if so how? Ocean evaporation is a large component of this. Agriculture would be affected by this also
  - Energy. Improved winds, boundary layer stability information is of value to for instance off-shore wind farms. Future wave energy retrieval will be affected by quality of ocean model surface forcings. Ocean heat content component affected by surface fluxes.
  - Society. Extremes, and their distributions, may be changing over time. High-quality climate data including surface parameters are needed to evaluate this possibility.

Trends/Extremes



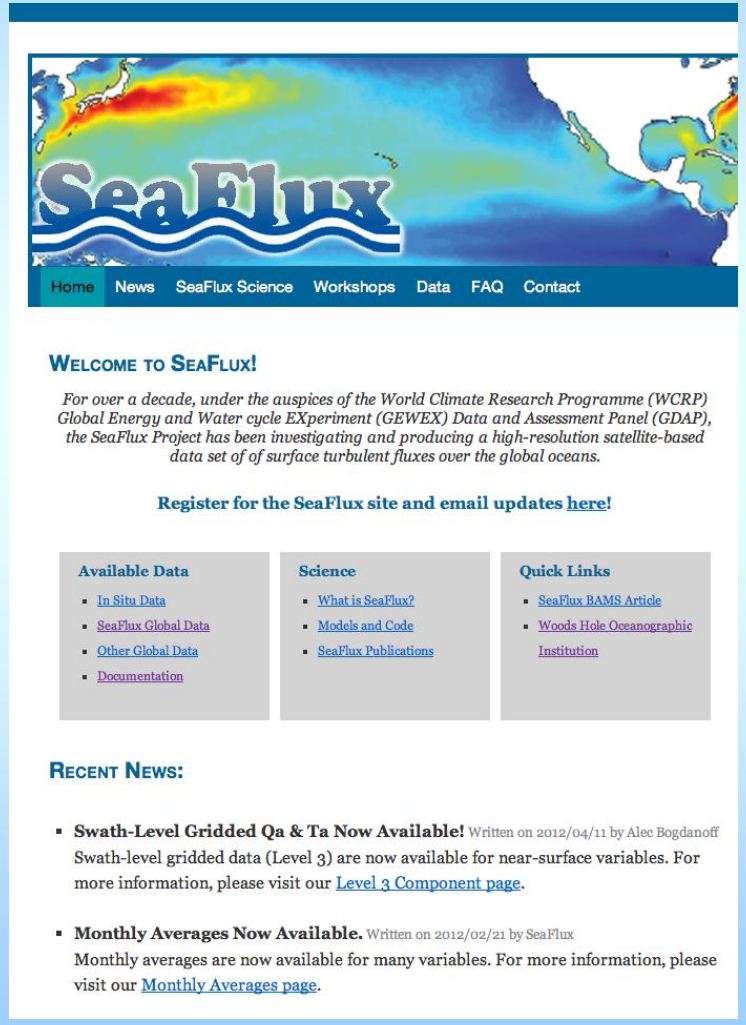






Current distribution of data

- Have not yet been advertising the data in any significant way
- > 100 users (required to register before downloading data), 1 – 2 new users per day
- Have several days in which > 10% of WHOI traffic has been downloading of SeaFlux data
- Users from:
  - Universities (US, China, India, Japan, Canada, South Africa, Czech Republic, Denmark, Ireland, Russia)
  - German Weather Service
  - Nansen Environmental and Remote Sensing Center
  - NRL
  - National Oceanography Center
  - JPL
  - 5th Grade Science Class, Canopy Oaks Elementary School, Tallahassee, FL



Schedule & Issues

- State project status and plans for next phase of the project
  - Version 1 completion
    - Overall dataset with uncertainty analysis paper to be completed and published
    - Uncertainty estimates to be included with dataset
  - Version 2 changes
    - Decision between CSU/RSS brightness temperatures, SSTs, etc.
    - New neural nets with final TB dataset
    - Change from binary to NetCDF
    - Change from equal angle to equal area grid
  - Anticipated date for version 2: July 2013
- State any risks or concerns
  - Possible no-cost extension
  - What exactly needs to be turned over (original proposal just discussed datasets, not code)
- How can the CDR Program better assist you?
  - Support dealing with issues relating to turn over of coding